

Onan

RV GenSet

Operator's Manual

BGM, NHM



Printed in U.S.A.

965-0131

3-93

Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

FUEL AND FUMES ARE FLAMMABLE. Fire, explosion, and personal injury can result from improper practices.

- DO NOT fill fuel tanks while engine is running. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible, non-conductive line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

GASOLINE AND LPG FUEL MAY BE ACCIDENTALLY IGNITED BY ELECTRICAL SPARKS, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

- Do not tie electrical wiring to fuel lines.
- Do not run electrical lines and fuel lines through the same compartment openings.
- Keep electrical and fuel lines as far apart as possible.
- Place a physical barrier between fuel lines and electrical lines wherever possible.
- If electrical and fuel lines must pass through the same compartment opening, make certain that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

- Never sleep in the vehicle with the generator set running unless vehicle is equipped with an operating carbon monoxide detector.
- Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Be sure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator set, disconnect batteries. This will prevent accidental arcing.

- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry while working on generator sets. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Have a fire extinguisher nearby. Maintain extinguisher properly and become familiar with its use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.
- Hot coolants under pressure can cause severe personal injury. DO NOT open a radiator pressure cap while the engine is running. Stop the engine and carefully bleed the system pressure.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which presents a potential fire hazard.
- DO NOT store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Table of Contents

SECTION	TITLE	PAGE
	SAFETY PRECAUTIONS	Inside Front Cover
1	INTRODUCTION	1-1
	About This Manual	1-1
	How to Obtain Service	1-1
2	SPECIFICATIONS	2-1
3	OPERATION	3-1
	General	3-1
	Pre-Start Checklist	3-1
	Lubrication	3-2
	Recommended Fuel	3-2
	Control Panel	3-2
	Remote Control Panel (Optional)	3-3
	Starting Procedure	3-3
	Operating Recommendations	3-4
	Troubleshooting Guide	3-6
4	MAINTENANCE	4-1
	General	4-1
	Periodic Maintenance Schedule	4-1
	General Inspection	4-2
	Lubrication System	4-2
	Battery Care	4-4
	Spark Arrester	4-4
	Air Filter	4-4
	Fuel Filter (Gasoline)	4-5
	Fuel Filter (LPG Fuel)	4-5
	Spark Plugs	4-6
	Cleaning the Generator Set	4-6
	Cleaning Carburetor and Combustion Chamber	4-7
	Inspect and Clean Engine (Internal)	4-7
	Out-of-Service Protection	4-8

Section 1. Introduction

ABOUT THIS MANUAL

This manual provides information for operating and maintaining the Onan® BGM and NHM (Marquis™) recreational vehicle generator sets. Study this manual carefully and comply with all warnings and cautions. Using the generator set properly and following a regular maintenance schedule will result in longer unit life, better performance, and safer operation.

HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact your nearest dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

If unable to locate a dealer or distributor, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS-ELECTRIC,
ENGINES-GASOLINE OR DIESEL, or
RECREATIONAL VEHICLES-EQUIPMENT,
PARTS AND SERVICE.

For the name of your local Cummins/Onan or Onan-only distributor in the United States or Canada, call 1-800-888-ONAN (this automated service utilizes touch-tone phones only). By entering your area code and the

first three digits of your local telephone number, you will receive the name and telephone number of the distributor nearest you.

For the name of your local Cummins-only distributor, or if you need more assistance, please call Onan Corporation, 1-612-574-5000, 7:30 AM to 4:30 PM, Central Standard Time, Monday through Friday.

When contacting your distributor, always supply the complete Model Number and Serial Number as shown on the generator set nameplate.

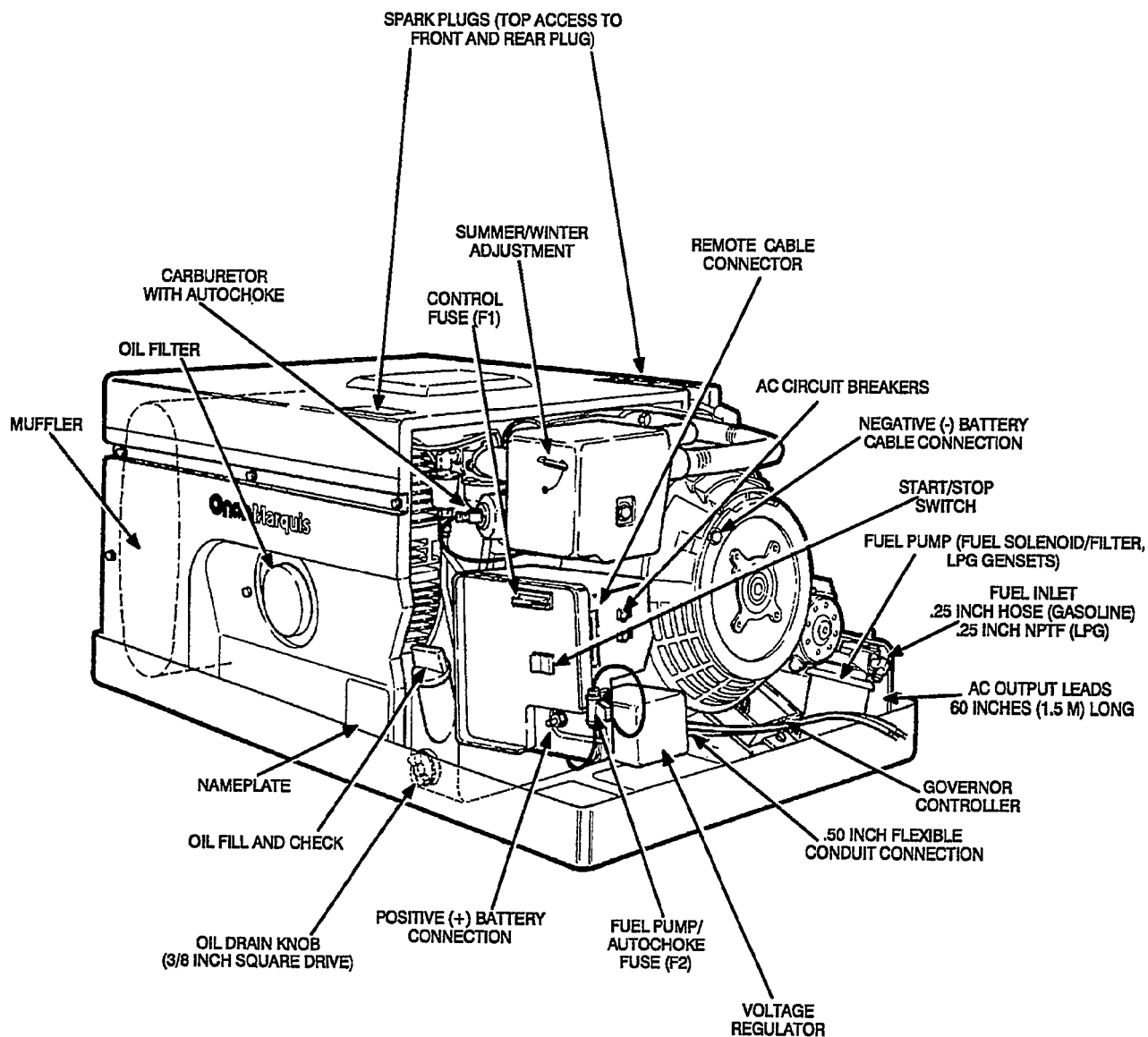
Model No.		
AC Volts:	Ph:	kW:
Amps:	PF:	RPM:
Fuel:	Hr:	Bat.: 12 V
Insulation - NEMA Class		Ambient 40°C
For Recreational Vehicle Use Only Pour Usage Dans Les Vehicules Recreatifs		
Onan Corp. 1400 73rd Ave NE Minneapolis, MN 55432 USA		
		Made in USA LEB

99-2411

FIGURE 1-1. ONAN NAMEPLATE

⚠ WARNING

INCORRECT SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.



M1801-3s

FIGURE 1-2. MARQUIS GENERATOR SET, SPEC D

Section 2. General Specifications

MODEL	BGM	NHM
GENERATOR DETAILS		
Power (Watts)	5000	7000 (gasoline), 6500 (LPG)
Voltage	120 VAC	120 VAC
Current (Amperes)	41.7	58.3 (gasoline), 54.2 (LPG)
ENGINE DETAILS		
Engine Speed	1800 RPM	1800 RPM
Engine Oil Capacity (Includes Filter)	3.5 qt. (3.3 L)	3.5 qt. (3.3 L)
Fuel	Gasoline	Gasoline, LPG (propane)
Fuel Inlet Connection (gasoline) (LPG)	1/4 in. barb fitting	1/4 in. barb fitting 1/4 in. NPTF
Average Fuel Consumption:		
No Load (gasoline) (LPG)	0.4 gph (1.5 Lph)	0.4 gph (1.5 Lph) 0.5 gph (1.89 Lph)
Half Load (gasoline) (LPG)	0.6 gph (2.3 Lph)	0.7 gph (2.6 Lph) 1.0 gph (3.78 Lph)
Full Load (gasoline) (LPG)	0.9 gph (3.4 Lph)	1.4 gph (5.2 Lph) 1.6 gph (6.06 Lph)
Battery Requirements:		
Battery	One, 12-volt	One, 12-volt
Cold Cranking Amps	360	360
Cold Cranking Amps below 32° F (-0° C)	450	450
GENERATOR SET DETAILS		
Weight	255 lb (116 kg)	272 lb (123 kg)
Height	15.0 in. (394 mm)	15.0 in. (394 mm)
Length	33.6 in. (854 mm)	33.6 in. (854 mm)
Width	22.3 in. (566 mm)	22.3 in. (566 mm)
Control Fuse	10 Ampere	10 Ampere
Fuel Pump/Autochoke Fuse	10 Ampere	10 Ampere
Air Requirement	450 ft ³ /min 12.6 m ³ /min	450 ft ³ /min 12.6 m ³ /min
TUNE-UP SPECS		
Spark Plug Gap	0.025 in. (0.64 mm)	0.025 in. (0.64 mm)
Timing (non-adjustable)	14°-18° BTC	14°-18° BTC
Valve Lash: Intake	0.005 in. (0.13 mm)	0.005 in. (0.13 mm)
Exhaust	0.013 in. (0.33 mm)	0.013 in. (0.33 mm)
Cylinder Compression (hot)	75-115 psi (517-793 kPa)	100-120 psi (690-827 kPa)

Section 3. Operation

⚠WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- *Dizziness*
- *Nausea*
- *Headache*
- *Weakness and Sleepiness*
- *Throbbing in Temples*
- *Muscular Twitching*
- *Vomiting*
- *Inability to Think Coherently*

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. *If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.*

Never sleep in the vehicle with the generator set running unless the vehicle interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.

GENERAL

This section describes starting and operating the genset. Read through this entire section before starting the set. Be completely familiar with the set to operate it safely.

PRE-START CHECKLIST

- **Open the access door and inspect the set and the entire exhaust system.** Look for loose or damaged components and fasteners. Correct all problem areas before operating the set.

⚠WARNING *Exhaust gas presents the hazard of severe personal injury or death. Make certain that all exhaust components are operational and secure.*

- **Do not start the genset while a load is connected.** Make certain that the output switching device on the vehicle (if present) is in the "Utility" position, and that the vehicle AC distribution panel breakers are off (open).
- **Do not start the set if exhaust gases will not effectively expel away from the vehicle.**

⚠WARNING *Exhaust gases can cause severe personal injury or death. Never operate the generator set unless the exhaust outlet is clear of walls, snow banks, or any obstructions that can prevent exhaust gases from dissipating. Never operate any exhaust fan in the vehicle when the generator set is running: an exhaust fan can draw exhaust gas into the vehicle.*

- **Make sure that the vehicle is not parked in high grass or brush.**

⚠WARNING *Fire can cause severe personal injury or death. Do not operate the generator set when the vehicle is parked in high grass or brush.*

⚠WARNING *Contact with used engine oil can cause cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.*

⚠WARNING *Hot oil can cause severe burns if spilled or splashed on skin. Keep fingers and hands clear when removing oil drain plug, and wear protective clothing.*

- **Make sure the fuel tanks are full.** See the *Recommended Fuels* section.

⚠ WARNING Gasoline presents the hazard of fire or explosion, which can result in severe personal injury or death. Do not smoke or allow any flame, spark, pilot light, arc-producing equipment or other ignition sources around fuel or fuel components. Keep a type ABC fire extinguisher nearby.

LUBRICATION

Check the engine oil level frequently. Keep the level close to the oil fill level indicator FULL mark, but do not overfill. See the *Maintenance* section for lubrication procedures.

RECOMMENDED FUEL

Gasoline Models

Use clean, fresh unleaded gasoline. (Regular leaded may be used if necessary.) Unleaded gasoline promotes extended service intervals, longer spark plug life, and less engine carbon clean-out maintenance. If leaded gasoline is used, lead deposits must be removed periodically from the cylinder heads, to reduce engine power loss. Unleaded gasoline may be used after leaded gasoline only if these lead deposits are removed.

Gasoline fuels deteriorate over time causing fuel system corrosion and the formation of gum and varnish-like deposits. These deposits cause hard starting and rough engine operation. If the generator set will not be operated for more than 120 days, a fuel preservative and stabilizer, like OnaFresh™, should be used to protect the fuel system and reduce contaminant formation (refer to Out-Of-Service Protection in the *Maintenance* section).

OnaFresh is a trademark of the Onan Corporation.

⚠ CAUTION Engine damage may result from alternating unleaded and leaded (regular) gasoline, unless lead deposits are removed from the cylinder head area before switching to unleaded gasoline.

LPG Models

Use clean, fresh commercial propane or HD-5 grade LPG in a mixture of at least 90 percent propane. Propane fuels other than HD-5 may cause poor fuel vaporization and poor engine starting in low ambient temperatures (below 32° F or 0° C).

A manual shutoff valve must be mounted on the propane fuel supply tank. This valve must be opened fully when operating the generator set, to make certain that the excess flow valve will close if the propane fuel line is broken.

CONTROL PANEL

Figure 3-1 shows the set control panel.

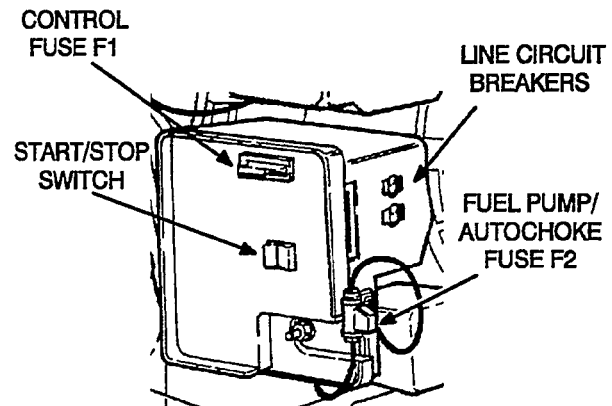
Control Components

Start/Stop Switch: Starts and stops the set locally. The set can also be operated from an optional remote control wired to the set control panel.

Control Fuse: Control fuse F1 provides protection for the control box wiring and remote wiring from a short or overloaded circuit.

Line Circuit Breakers: Circuit breakers CB1 and CB2 protect the generator from a short or overloaded circuit.

Fuel Pump/Autochoke Fuse: Fuse F2 protects the electric fuel pump and electrically actuated choke from a short or overloaded circuit.

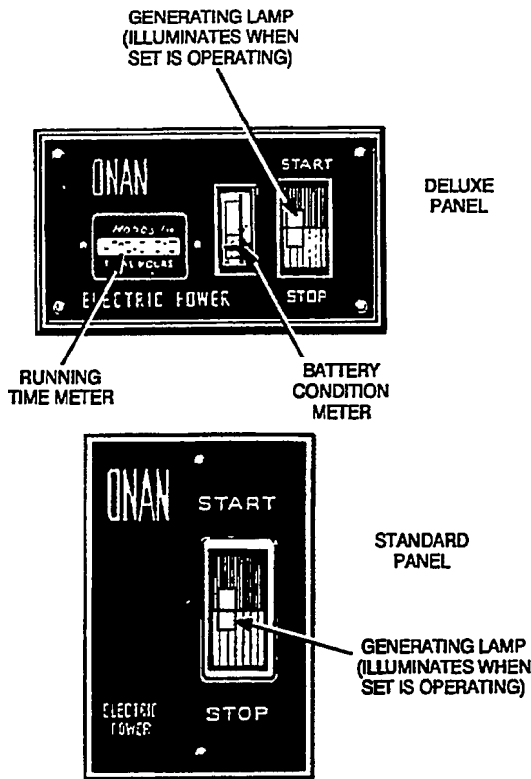


M1801s

FIGURE 3-1. GENERATOR SET CONTROL PANEL

REMOTE CONTROL PANEL (OPTIONAL)

The optional remote control panels (Figure 3-2) enable the genset to be run from inside the RV living quarters or driver's area.



ES1684a-1

FIGURE 3-2. REMOTE CONTROL PANELS

Standard Remote Control: This has a Start/Stop switch and an indicator lamp that lights when the set is running.

Deluxe Remote Control: Has the same features as the standard remote control plus a running time meter and a battery condition meter, described below. See Figure 3-2.

Running Time Meter: Indicates cumulative total hours of genset use. During generator set maintenance, record the length of time shown on this meter.

Battery Condition Meter: Indicates the condition of the battery and the battery charging circuit. The

indicator should remain in the normal zone. If it reads consistently high or low, contact an Onan service center for assistance.

STARTING PROCEDURE

For initial start-up of a new generator set, refer to the *Break-in Procedure* section of this manual.

1. Inspect the generator set. Follow the Prestart Checklist procedures listed at the beginning of this section.
2. Disconnect all loads before starting the genset.
3. Move the Start/Stop switch to START. Release the switch when the genset starts.
4. Let the set warm up before connecting a load. Make sure that the set is running smoothly and that there are no fuel or exhaust leaks. Correct any problems immediately.
5. Apply load. See the *Specifications* section of this manual for set output and performance ratings.

CAUTION Continuous generator set overloading can cause high operating temperatures that could damage the generator windings. Keep the load within the nameplate rating.

Remote Starting

Hold the Start/Stop switch on the remote control in the START position until the set starts (lamp should burn brighter and remain on after switch is released).

If the switch is held at START for ten seconds and the lamp does not remain on when the switch is released, wait two minutes and try again. If the second try does not start the genset, start the set using the Start/Stop switch on the set. If the lamp still does not light, there may be an open in the remote wiring. Contact an Onan service center for assistance.

Stopping

1. Remove all loads from the genset output.
2. Let the set run three to five minutes to cool down.
3. Push the Start/Stop switch to the STOP position at the genset control or at the remote control.

OPERATING RECOMMENDATIONS

Break-In Procedure

To prevent high oil consumption or glazing of the engine cylinders, perform the break-in procedure described below:

1. After starting, apply a load to the genset of half its capacity and run the set for two hours. See the *Specifications* section for the set capacity. Table 3-1 lists the wattage requirement of common appliances.
2. Increase the load to three-quarters capacity and run the set for another two hours.
3. Change the engine crankcase oil after 50 hours of operation, and every 150 hours after that. See the *Maintenance* section of this manual for more information.

**TABLE 3-1. APPROXIMATE POWER USAGE
OF COMMON APPLIANCES**

Appliance or Tool	Approximate Running Wattage
Air Conditioner	1400-2000
Battery Charger	Up to 800
Coffee Percolator	550-750
Converter	300-500
Electric Blanket	50-200
Electric Broom	200-500
Electric Drill	250-750
Electric Frying Pan or Wok	1000-1500
Electric Iron	500-1200
Electric Stove (Per Element)	350-1000
Electric Water Heater	1000-1500
Hair Dryer	800-1500
Microwave Oven	1000-1500
Radio	50-200
Refrigerator	600-1000
Space Heater	1000-1500
Television	200-600

Connecting A Load

Allow the set to warm up before applying a heavy load. Overloading can cause high operating temperatures and damage the set. Keep the load within the nameplate rating.

Hot Weather

Keep the cooling fins clean at all times, especially in weather hotter than 90°F/33°C. Make certain that nothing blocks the airflow to and from the genset. Make certain that the set is well-maintained (see the Periodic Maintenance Schedule in Section 4 of this manual). Do not overload the set.

Cold Weather

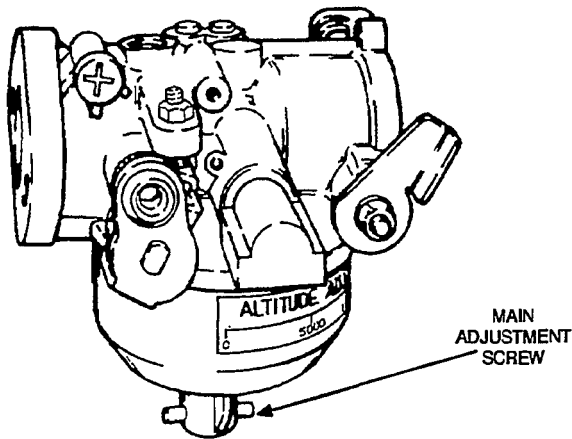
Use the right oil type and weight for cold weather conditions. See the *Maintenance* section of this manual for oil recommendations. Change the oil only after the engine is warmed up. If a sudden temperature change occurs and the oil is not the correct viscosity, replace the oil as required.

Gasoline Models Only: At temperatures below 40°F/4°C, move the carburetor air preheater lever to the WINTER position. This lever is found on the outside of the air cleaner housing (see Figure 4-4). At temperatures above 70°F/21°C, move the preheater lever to the SUMMER position. At temperatures between 40°F/4°C and 70°F/21°C, the preheater may be left in either position.

CAUTION *Operation of the preheater when temperatures are above 70°F/21°C can cause erratic operation, and can result in reduced engine power and reduced engine life. For this reason, leave the preheater in the SUMMER position at high ambient temperatures.*

High Altitudes

Maximum power will be reduced about four percent for each 1000 feet (310 m) above sea level after the first 1000 feet (310 m). On gasoline sets, if operation is inhibited by high altitude (above 2000 feet or 620 m), adjust the carburetor main fuel adjustment for a slightly leaner fuel mixture. Turn the main fuel adjustment in 1/8 turn. See Figure 3-3.



FS-1692-2

FIGURE 3-3. GASOLINE CARBURETOR
MAIN ADJUSTMENT SCREW

If this is a persistent problem on an LP-fueled set, contact an Onan service center for a fuel system adjustment.

CAUTION *Fuel mixture adjustment needles and seats can easily be damaged. When adjusting fuel mixture settings, never force the fuel mixture adjustment needles against their seats.*

Extremely Dusty or Dirty Conditions

1. Keep the generator set and its cooling surfaces as clean as possible.
2. Service the air cleaner frequently.
3. Change the engine crankcase oil every 50 operating hours.
4. Keep oil in a dust-tight container.
5. Keep the governor linkage clean. See the *Maintenance* section for this procedure.

Generator Set Exercise

Infrequent operation of the generator set can encourage moisture to condense in the engine, making starting difficult. Moisture accumulates because the engine does not run often enough to reach normal operating temperature. This moisture can damage the engine.

To prevent moisture damage, run the generator set at 50 percent capacity (see *Specifications* section) two hours every four weeks. A long exercise period is preferable to several short periods.

TABLE 3-2. TROUBLESHOOTING GUIDE

The following is a simplified troubleshooting guide. If these recommendations fail to resolve the problem, contact an authorized Onan service center.

⚠WARNING

Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.

Problem	Probable Cause	Solution
FAILS TO CRANK	<ol style="list-style-type: none"> 1. Low battery. 2. Bad battery connection. 3. Blown fuse. 	<ol style="list-style-type: none"> 1. Check battery electrolyte level. 2. Clean and tighten all battery and cable connections. 3. Replace fuse on control box.
CRANKS SLOWLY	<ol style="list-style-type: none"> 1. Low battery. 2. Bad battery connection. 3. Oil is too heavy. 4. Load connected. 	<ol style="list-style-type: none"> 1. Check battery electrolyte level. 2. Clean and tighten all battery and cable connections. 3. Replace with lighter oil. 4. Disconnect load while starting.
CRANKS BUT WON'T START	<ol style="list-style-type: none"> 1. Fuel below genset pickup level in tank. 2. Fuel supply shutoff valve closed. 3. Carbon deposits on spark plugs. 4. Low oil level. 	<ol style="list-style-type: none"> 1. Add fuel. 2. Fully open fuel supply valve. 3. Remove spark plugs and clean. 4. Add oil if necessary.
EXHAUSTING BLACK SMOKE	<ol style="list-style-type: none"> 1. Rich fuel mixture. 2. Dirty air filter. 3. Choke stuck. 	<ol style="list-style-type: none"> 1. (Gasoline sets) Turn main fuel adjustment in 1/8 turn (see Figure 3-3). (Altitude adjustment only; otherwise, contact an Onan service center.) 2. Replace air filter. 3. Contact an Onan service center.
UNIT RUNS THEN STOPS	<ol style="list-style-type: none"> 1. Out of fuel. 2. Low oil level. 3. Excess oil. 	<ol style="list-style-type: none"> 1. Refill fuel tank. 2. Add oil if necessary. 3. Reduce engine oil level.
UNIT RUNS THEN SURGES	<ol style="list-style-type: none"> 1. Loose or worn spark plug leads. 2. Ignition coil, wiring, or control components defective. 3. Faulty spark plugs. 4. Governor defective. 5. Incorrect fuel mixture. 	<ol style="list-style-type: none"> 1. Check security of spark plug leads at spark plug and ignition coil. 2. Contact an Onan service center. 3. Remove and clean or replace. 4. Contact an Onan service center. 5. Contact an Onan service center.

⚠WARNING A hot generator set can cause severe burns. Always allow the generator set to cool before performing any maintenance or service.

Section 4. Maintenance

GENERAL

Establish and stick to a maintenance and service schedule. In extreme operating conditions, reduce maintenance intervals accordingly.

Consult an authorized Onan service center if the generator set is subject to extreme conditions, to draw up a more frequent maintenance schedule. Log all service and maintenance for warranty support.

Perform all maintenance at the number of operating hours indicated. Use the schedule to determine the maintenance required, and then refer to the sections that follow for the correct procedures.

⚠WARNING *Accidental starting of the generator set during maintenance can cause severe personal injury or death. Disconnect both generator set starting battery cables, before performing maintenance. Remove the negative (-) cable first to reduce the risk of arcing.*

TABLE 4-1. PERIODIC MAINTENANCE SCHEDULE

Service These Items	After Each Cycle of Indicated Hours			
	8	50	150	500
General Inspection	x ¹			
Check Oil Level	x			
Check Battery Electrolyte Level		x		
Clean Out Spark Arrestor		x		
Inspect and Clean Governor Linkage				x ⁵
Change Crankcase Oil and Oil Filter			x ^{2,6}	
Change Air Filter			x ²	
Clean Carburetor & Combustion Chamber w/Onan "4C" Cleaner			x	
Replace Spark Plugs				x ⁴
Inspect and Clean Internally Engine Combustion Chamber				x ⁵
Replace Fuel Filter				x ³
Adjust Carburetor	As Required ⁵			
Check Generator Brushes	As Required ⁵			
Clean Generator Set	As Required ⁵			
Clean Cooling Fins	As Required ⁵			
Exercise Generator Set	As Required ⁷			

¹ Before operating the set each day, or at least every 8 hours, check for oil and fuel leaks. Check exhaust system audibly and visually with generator set running. Shut down the set and repair any leaks immediately. Replace corroded exhaust and fuel line components before leaks occur. Make sure exhaust pipe extends beyond the perimeter of the RV.

² Every 150 operating hours or once a year, whichever is first. Perform more often in extremely dusty conditions (i.e. check monthly, and change if dirty).

³ Replace fuel filter at carburetor, clean screen at fuel pump⁵.

⁴ Refer to Out-of-Service Protection if unit is to be stored.

⁵ Have your Onan Service Center perform.

⁶ First oil change during first year or 50 hours of operation, whichever is first.

⁷ During periods of nonuse, exercise for 2 hours every 4 weeks.

GENERAL INSPECTION

Do an inspection of the generator set at least every eight operating hours. Start the set and check for visible and audible irregularities.

Exhaust System

Examine the exhaust system for leaks. Inspect the set compartment for holes that might allow exhaust gas to enter the vehicle. If the genset runs louder than usual, if the compartment has holes to the interior, or if the exhaust system leaks, do not operate the set. Consult an Onan service center as soon as possible, and do not run the set until the problem is corrected.

Replace worn, damaged, or corroded exhaust components before leaks occur.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. If there are any exhaust leaks, do not operate the generator set, and have the exhaust system repaired before using the generator set.*

Fuel System

With the generator set running, check the fuel supply line, return line, filter, and fittings for leaks. Check all flexible sections for cuts, cracks, and abrasions, and make sure they do not rub against anything that could break them. Replace worn or hardened fuel line components before leaks occur.

⚠ WARNING *Fuel presents the hazard of fire or explosion that can result in severe personal injury or death. If any leaks are detected, have them corrected immediately.*

DC Electrical System

With the genset off, check the battery terminals for clean and tight connections. Loose or corroded connections create resistance that can impede starting. Clean and reconnect loose battery cables. Remove the negative (-) battery cable first and install it last to reduce the risk of arcing.

Mechanical

With the genset stopped, check for any signs of mechanical damage and investigate anything that indicates possible mechanical problems. With the set running, listen for any unusual noises that may indicate mechanical problems. If any problems are found, have them corrected immediately.

LUBRICATION SYSTEM

The engine oil was drained from the crankcase prior to shipment. Before the initial start, the engine must be filled with oil of the recommended classification and viscosity. Refer to the *Specifications* section for the lubricating oil capacity.

Be sure the engine crankcase is filled with oil to the FULL mark on the oil level indicator (Figure 4-1). If adding oil between changes, use the same brand; different brands might not be compatible when mixed. See Recommended Engine Oil in this section.

Add oil until it reaches the FULL mark on the oil level indicator (see Checking Engine Oil Level). Make certain not to overfill; excess oil may foam in the crankcase and stop the engine. Always replace the oil level indicator tightly, to avoid leakage.

⚠ WARNING *Hot oil can cause severe personal injury. Do not check the oil level while the generator set is running: oil may blow out of the oil fill tube.*

Checking Engine Oil Level

1. Remove the oil level indicator and wipe it with a clean rag.
2. Screw the oil level indicator back into its normal operating position (fully in).
3. Unscrew the indicator again, and check the oil level on the indicator stem.
4. Add oil as described above.

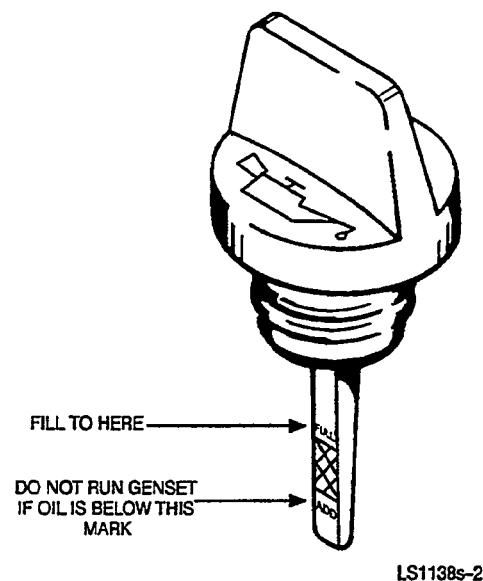


FIGURE 4-1. OIL LEVEL INDICATOR

Figure 1-2 shows the location of the oil drain, oil filter, and oil level indicator. In dusty or dirty conditions, change the oil more frequently than is specified in the maintenance schedule.

Run the engine until warm before draining the oil.

⚠WARNING *Hot oil can cause severe burns if spilled or splashed on skin. Keep fingers and hands clear when removing oil drain plug, and wear protective clothing.*

Oil Draining Procedure

1. Place a pan under the oil drain valve.
2. Open the valve and allow oil to drain from the engine.
3. Close the valve.
4. Dispose of the old oil properly.

⚠WARNING *Contact with used oil can cause cancer or reproductive toxicity. When checking or changing engine oil take care not to ingest, breath the fumes, or contact used oil.*

Oil Filter Changing Procedure:

1. Place an oil pan under the oil filter location on the engine.

2. Turn the old filter counterclockwise to remove it.
3. Replace the oil filter with a new Onan-approved oil filter. Coat the new filter gasket lightly with clean engine oil.
4. Turn the new filter clockwise until its gasket just touches the filter mounting base, then tighten it an additional half turn.
5. Wipe up excess oil.

Refer to the *Specifications* section of this manual for the engine oil capacity. See Recommended Engine Oil (below) to select the proper grade of oil.

Recommended Engine Oil

Use oil with the API (American Petroleum Institute) designation SG. Oil should be labeled as having passed MS Sequence Tests (also known as ASTMG-1V Sequence Tests). Refer to Figure 4-2 for recommended viscosity and temperatures.

Oil consumption may be higher with a multigrade oil than with a single-grade oil, if they have similar viscosity at 210° F (99° C). For this reason, single-grade oils are preferable unless wide temperature variations are anticipated.

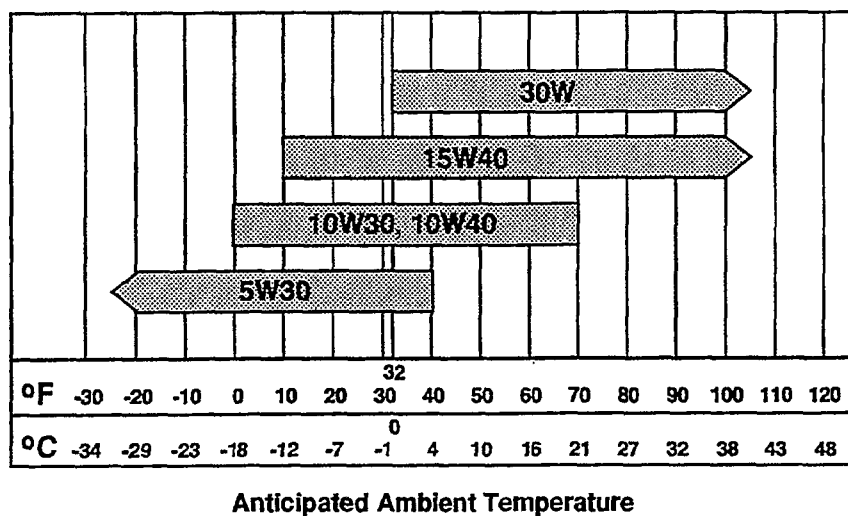


FIGURE 4-2. SAE VISCOSITY GRADES

BATTERY CARE

To increase battery life, perform these routine checks and preventive measures.

⚠WARNING *Accidental starting of the set can cause severe personal injury or death. Disconnect the battery cables when repairs are made to the engine, controls, or generator. Always disconnect the negative (-) cable first, to reduce the risk of arcing.*

1. Keep the battery case clean and dry.
2. Make certain that the battery cable connections are clean and tight. To remove the battery cables, use a terminal puller tool.
3. Identify the cable as positive (+) or negative (-) before making the connection. Always connect the negative (-) cable last, to reduce the risk of arcing.
4. Maintain the electrolyte level by adding distilled water as needed to reach the split-level marker in the battery. The water component of the electrolyte evaporates, but the sulfuric acid component remains. For this reason, add water, not electrolyte to the battery.
5. Charge the battery only if the specific gravity measures less than 1.215. Avoid overcharging the battery. Stop the boost charge when the electrolyte specific gravity reaches 1.260, at approximately 80° F (27° C).

⚠WARNING *Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves, and a protective apron when working with batteries.*

⚠WARNING *Batteries present the hazard of explosion, which can result in severe personal injury. Do not smoke or allow any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources around the battery area. Do not disconnect battery cables while the generator set is cranking or running: batteries give off explosive gases.*

SPARK ARRESTER

The spark arrester in the set muffler is necessary for safe operation of the generator set. It requires periodic cleaning to maintain maximum efficiency. Consult the maintenance schedule for recommended cleaning intervals.

Spark Arrester Cleaning Procedure:

1. Remove the 1/8-inch pipe plug from the bottom of the muffler.
2. Run the generator set with load for five minutes.
3. Stop the generator set and allow the muffler to cool.
4. Replace the pipe plug in the muffler.

AIR FILTER

In dusty conditions, change the air filter often. Replace the air filter only with an Onan-approved filter. To remove the old filter, remove the through-bolt on the side of the air cleaner housing (Figure 4-4).

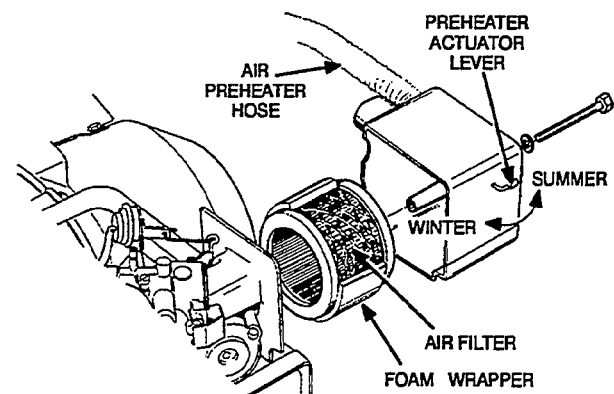


FIGURE 4-4. REPLACING THE AIR FILTER

⚠CAUTION *The carburetor air preheater hose can easily be damaged by rough handling. When removing the air cleaner housing, be careful not to damage the carburetor air preheater hose, which is attached to the housing.*

FUEL FILTER (GASOLINE)

Change the fuel filter at the interval recommended in the Maintenance Schedule or if performance problems occur and bad fuel is suspected. Shut off the fuel supply valve and let the set run until it is out of fuel. Allow the generator set to cool down before replacing the fuel filter. Refer to Figure 4-5.

⚠ WARNING *Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Do not permit any flame, spark, pilot light, lit cigarette, or other ignition source near the fuel system.*

⚠ CAUTION *Incorrect replacement of service parts can result in damage to equipment. Use genuine Onan replacement fuel filters only.*

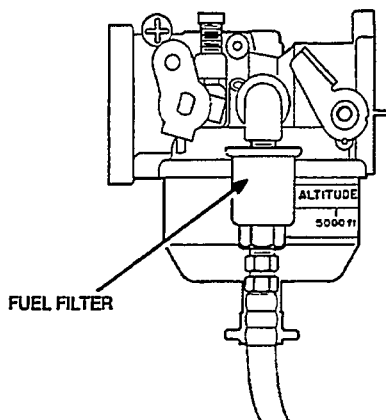


FIGURE 4-5. GASOLINE FUEL FILTER

FUEL FILTER (LPG FUEL)

The fuel filter (Figure 4-6) removes solid impurities from the LP gas, before they can reach the regulator and carburetor. A magnet in the filter housing captures iron and rust particles, and a filter element traps non-magnetic particles. Because the fuel filter operates at fuel container pressure, it must be reassembled carefully after cleaning, to prevent leakage.

To maintain the LPG fuel filter, purge the fuel system first, as described below.

Fuel System Purging Procedure

1. Close the shutoff valve at the fuel tank.
2. Start and run the generator set until it is out of fuel.
3. Crank the engine a few times after it has stopped, to make certain that it is purged of fuel.
4. Move the vehicle to a well-ventilated location that is far from fire, flame, pilot lights, arc-producing equipment, or other ignition sources.

5. Remove the vehicle negative (-) battery ground cable and the generator set negative (-) ground cable from their respective batteries.
6. Close the generator set fuel system shutoff valves, and all other shutoff valves, at the fuel tank.

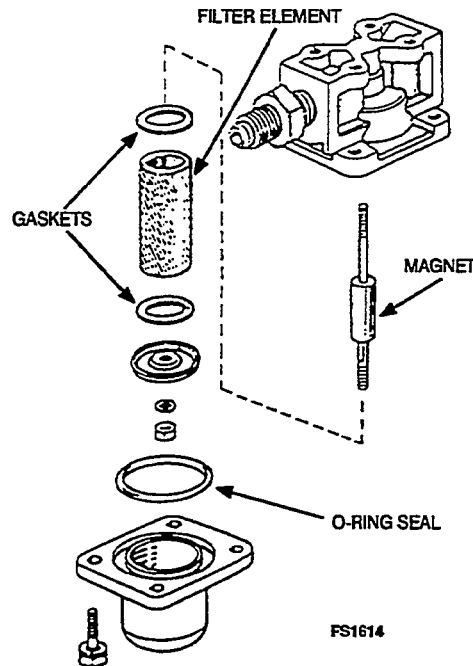


FIGURE 4-6. LIQUID LPG FUEL FILTER

⚠ WARNING *LP gas presents the hazard of fire or explosion, which can result in severe personal injury or death. Eliminate all sources of ignition, such as pilot lights, sparking, electrical equipment, flames, lit cigarettes, etc. before purging the fuel system. Provide adequate ventilation to dissipate LP gas as it is released.*

7. Open the section of flexible fuel line at the solenoid valve just enough to allow the gas to escape slowly.
8. Disconnect the fuel supply hose from the carburetor and hold it clear of the set.
9. Press and hold the primer button on the regulator to release LP gas from the generator set fuel system. When gas can no longer be heard escaping from the open end of the fuel supply hose, reconnect the hose to the carburetor and move to the procedures described under *LPG Fuel Filter Cleaning Procedure*.

LPG Fuel Filter Cleaning Procedure

1. Remove the four capscrews and lock washers that secure the filter bowl to the filter body.
2. Separate the filter bowl from the filter body and discard the O-ring seal.
3. Remove the nut and washer from the center stud and pull out the filter element.
4. If the filter element is clogged, wash the element in kerosene and blow it dry with low pressure (30 psi or 207 kPa) compressed air. Replace the filter element if damaged.

⚠WARNING *Kerosene presents the hazard of fire or explosion, which can cause severe personal injury or death. Do not smoke while using kerosene, or expose kerosene to any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources. Use great care when cleaning with kerosene.*

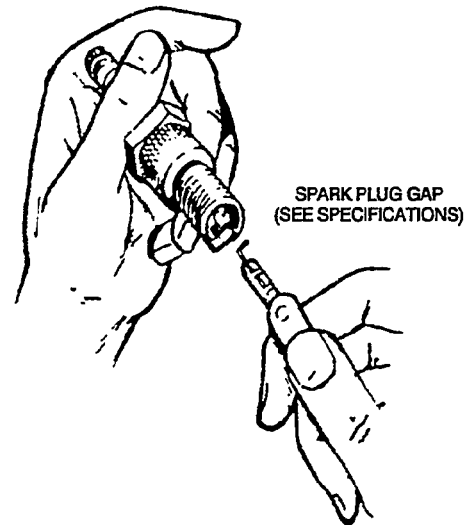
5. Wipe the center stud magnet clean of any rust or scale deposits. Do not tap the magnet to dislodge loose particles: this may damage the magnet.
6. Install a clean filter element using two new gaskets. Securely tighten the center and stud nuts.
7. Place a new O-ring in the filter bowl sealing groove.
8. Align the reference mark on the filter bowl with the reference mark on the filter body, and install the capscrews. Tighten the capscrews 56 to 74 in. lb. (6.5 to 8.3 N•M) torque. When the fuel system is pressurized, check the filter for leaks.

⚠WARNING *LPG presents the hazard of fire or explosion, which can result in severe personal injury or death. After the filter assembly is assembled and the fuel shutoff valve is turned on, apply a soap or detergent solution to the joint, to check for leaks. If there is a leak, bubbles will show in the area; turn off the shutoff valve immediately. If the problem cannot be determined, call the nearest Onan service center.*

SPARK PLUGS

A spark plug with heavy combustion deposits can cause the generator set to misfire, operate erratically, or stop when a load is applied. When the spark plugs are removed, inspect and regap them (Figure 4-7). If a plug is discolored or fouled, replace it.

- Black deposits indicate a rich mixture.
- Wet plugs indicate misfiring.
- Badly or frequently fouled plugs indicate the need for a major overhaul.



ES1374s

FIGURE 4-7. MEASURING PLUG GAP

CLEANING THE GENERATOR SET

Clean the set every six months, or more often if severe road contamination or dusty conditions are encountered. Dust usually can be removed with a damp cloth. Steam may be necessary to remove persistent dirt or tar. Do not steam-clean the generator set while the engine is running.

When cleaning the genset, protect the generator, air cleaner, control box, and electrical connectors from cleaning solutions. Do not clean with solvents; they may damage electrical connectors.

CLEANING THE CARBURETOR AND COMBUSTION CHAMBER WITH ONAN "4C"

⚠WARNING *Inhalation of chemical sprays can cause severe personal injury or death. Use safety goggles to protect eyes and a respirator or painter's mask to prevent inhaling any chemical that may spit back from the carburetor during this procedure. Also, work in a well-ventilated area so that other personnel will not inhale any fumes.*

⚠WARNING *Fumes from this cleaner present the hazard of fire or explosion, which can cause severe personal injury or death. Do not allow any spark, flame, pilot light, lit cigarette, or other ignition source near the generator set when performing this procedure. Keep a fire extinguisher rated ABC near work area. Perform the following steps, indicated on the maintenance schedule, to help keep the carburetor and intake manifold clean, and to keep carbon deposits from forming in the combustion chamber. If engine pinging or power loss occur, consult an authorized Onan service center.*

Before performing this procedure, move the vehicle to a well-ventilated outdoor location, far from any flame, spark, pilot light, arc-producing equipment or other ignition sources.

1. Start the genset and let it warm up to normal operating temperature.
2. Stop the genset.
3. Remove the air cleaner housing and air filter.
4. Restart the set, and spray the "4C" into the carburetor, directing the spray to wash the choke plate and inside walls of the carburetor. Spray as much as possible into the carburetor without stalling the engine.

The spray enters the combustion chamber and softens the carbon, which flakes off and is expelled

through the exhaust pipe. When about an ounce of the chemical remains in the can, flood the engine until it stops.

5. Do not start the engine for 15 minutes, while the "4C" continues to soften the carbon.
6. Restart the engine, with no electrical load connected. Increase the load on the generator set as gradually as is possible, to full load. Let the generator set run under full load for a few minutes, to expel the carbon.

INSPECT AND CLEAN ENGINE (INTERNAL)

Running the generator set under widely varying operating conditions, running the engine continuously at less than 50 percent load, and using fuel with impurities can impede engine performance and shorten engine life.

Also the use of gasolines having certain additives can cause carbon deposits to form on intake valves and ports. This condition started to appear in 1987 when gasoline companies increased the dosage of carburetor detergent additives to combat plugging of fuel injectors in automotive engines. Engine manufacturers then began to notice deposit formation on intake valves and ports. Components in the detergent additive and in the base gasoline stock can act as a binder to hold oil and fuel onto valve surfaces and cause deposit buildup.

Many brands of gasoline are now available which use a new generation of additive which cleans the fuel system as well as the intake valves and ports. The use of these gasolines, which are usually advertised as keeping the entire intake system clean, will minimize deposit formation both in your genset engine and in your RV engine.

Have the engine combustion chamber and intake ports inspected internally by an Onan service representative for component wear and carbon buildup per the Periodic Maintenance Schedule.

OUT-OF-SERVICE PROTECTION

If the generator set cannot be exercised regularly, and it will not be in use for more than 120 days, The following procedure is recommended. Failure to provide out-of-service protection can result in difficult starting, rough engine operation and reduced engine life.

Generator Set Storage Procedure

1. Add a fuel preservative and stabilizer, such as OnaFresh™, to the fuel supply. Follow manufacturer's instructions for using the fuel additive. Run the generator at 50 percent load (see *Specifications* section) for 30 minutes.

⚠WARNING *Fuel additives can cause a risk of personal injury. Read and follow manufacturer's instructions.*

2. Disconnect the load, switch AC breaker OFF, and stop the generator set at the set control.
3. Close the fuel supply valve and remove the air filter. Restart the generator set at the set control. As the generator set starts to run out of fuel (noticeable stumble or surge), spray fogger, such as OnaGard™, into the carburetor intake and reassemble the air filter. Follow manufacturer's instructions for using the fogger.
4. Replace the air cleaner after the engine stops. Remove the spark plug and ground the spark plug lead to prevent arcing. Spray OnaGard or engine oil up into the spark plug hole while cranking the engine for 3 seconds. Clean up excess oil and install the spark plug and plug wire.

OnaFresh and OnaGard are trademarks of Onan Corporation.

5. Drain the crankcase oil when the exhaust system has cooled. Refill the crankcase and attach a tag indicating viscosity of oil used.

⚠WARNING *Hot oil can cause severe burns if spilled or splashed on skin. Keep fingers and hands clear when removing oil drain plug, and wear protective clothing.*

6. Disconnect the cables from the starting battery, negative (-) cable first, to reduce the risk of arcing.

Returning the Generator Set to Operation

1. Inspect the generator set.
2. Check the battery electrolyte level, and reconnect the cables, negative (-) cable last, to reduce the risk of arcing.

⚠WARNING *Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves, and a protective apron when working with batteries.*

⚠WARNING *Batteries present the hazard of explosion which can result in severe personal injury. Do not smoke or allow any spark, flame, pilot light, arc-producing equipment or other ignition sources around the battery area.*

3. Check the air filter. If it is dirty, replace it.
4. Check the engine oil level.
5. Turn on the fuel supply.
6. Start the generator set at the set control. Initial startup may be slow, due to oil in the cylinders. Smoke and rough operation will occur until the oil in the cylinders is burned. If the engine does not start, replace the spark plugs.
7. Apply 50 percent load to the generator set until it runs smoothly. Run the generator set for an hour.
8. Remove the load and let the generator set run for three to five minutes to cool down. Then move the Start/Stop switch to the STOP position. The generator set is now ready for operation.



Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-ONAN
612-574-5000 International Use
Telex: 275477
Fax: 612-574-8087

Onan is a registered trademark of Onan Corporation